Higgs self-coupling analysis with H→WW*

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Studying Jet Properties

- dE/dx - restart study
  - Start from first step
- Shower profile - going on
  - Start basic study
  - Correct the fitting function and check the results

dE/dx

- Study starts @digitization step
  - Check whether dE/dx is working at the simulation
    - Check whether Bethe-Bloch can be seen
  - Check some dependence
  - Check the result after the correction

- dE/dx definition:
  - $\frac{dE}{dx} = \frac{energy\ deposit}{flight\ path\ in\ the\ hit(TPC)}$
  - dE/dx can be calculated at any hit point
  - Truncated mean is calculated as track dE/dx

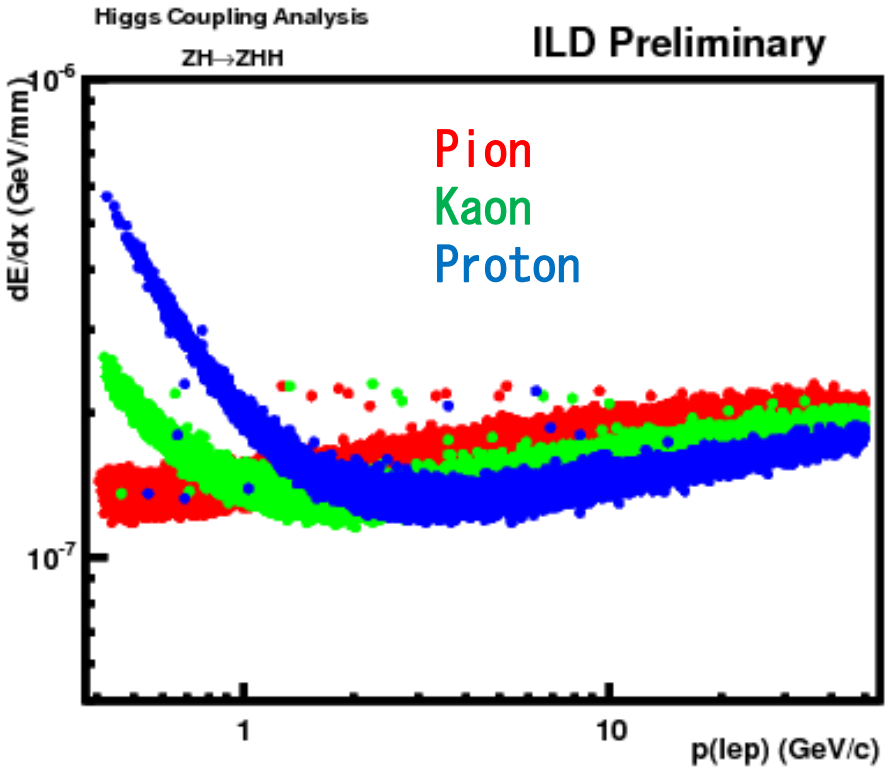
    $\left\langle \frac{dE}{dx} \right\rangle = \sum_i^n \frac{dE_i}{dx_i}$ upper 30%, lower 8% hits are discarded

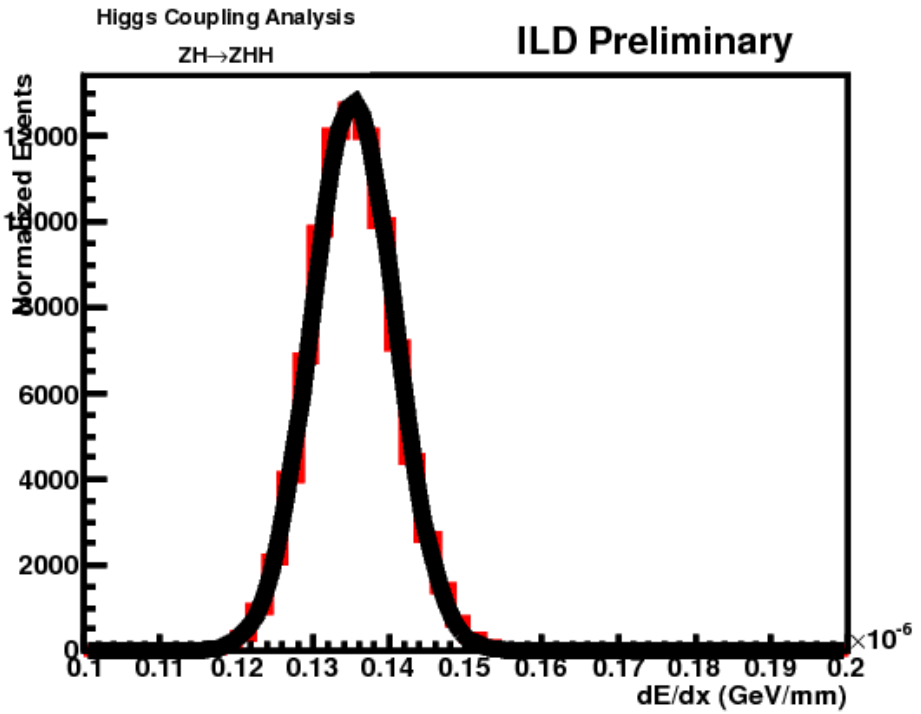
    to avoid Landau tail

    →optimization is necessary

From digitization step

- dE/dx - very clean Bethe-Bloch line can be seen!
  - Num. of hits used for dE/dx >=40
  - Simulation hit will be OK
- dE/dx distribution using MIP pion (p=0.3-0.7GeV/c)
  - The distribution is Gaussian
  - Truncated mean is reasonable so far, but need optimize



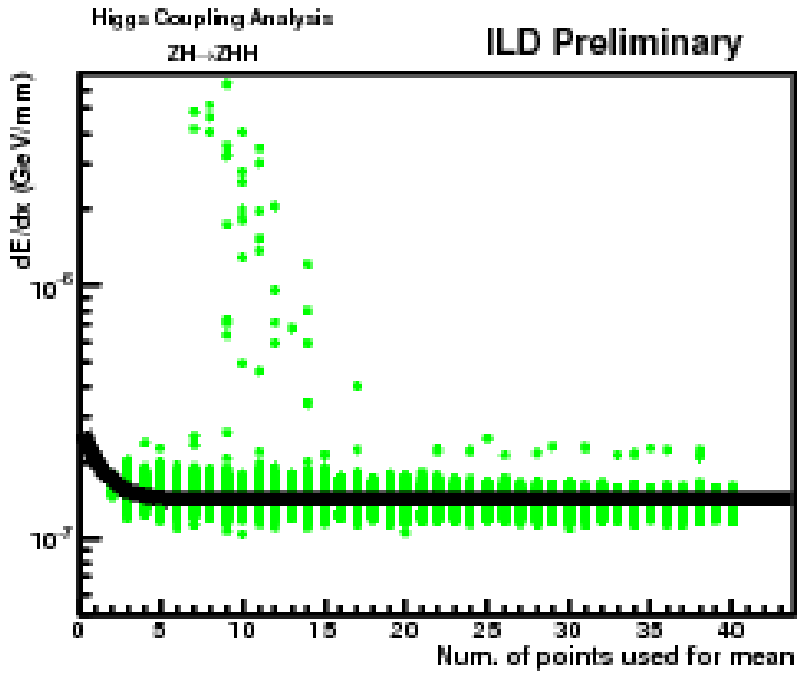


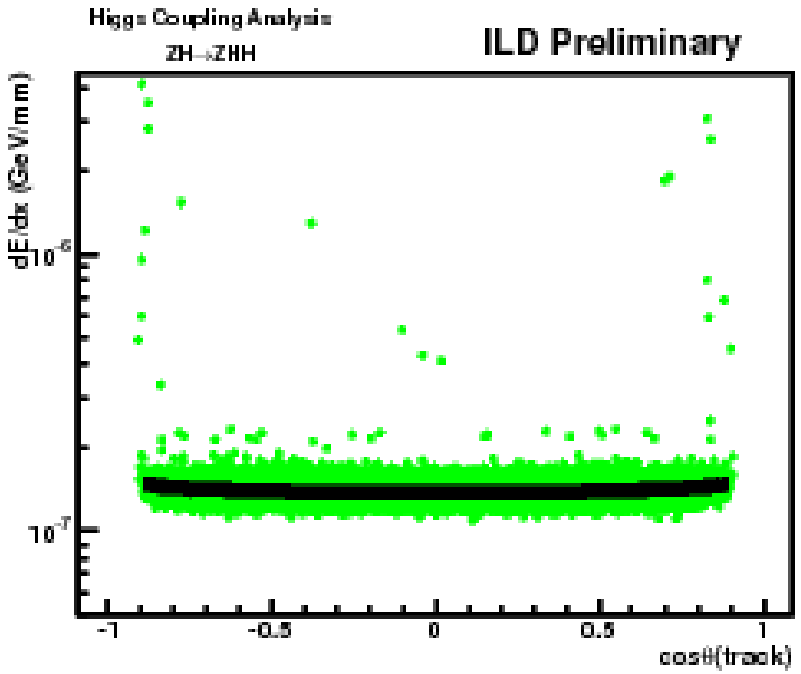
Check the dependence

- Use MIP pion (p=0.3-0.7GeV/c)
- To scale $\left\langle \frac{dE}{dx} \right\rangle_{MIP} = 1.0$
- So far, checking the dependence of
  - Num. of hits used for mean
  - Polar angle of the track
- Parameterization by fitting

dependence

- Num. of hits - Landau tail affects dE/dx when num. of hits is small
- Polar angle - dE/dx from short flight path is likely to make Landau tail
  - Wrong tendency against the expectation??

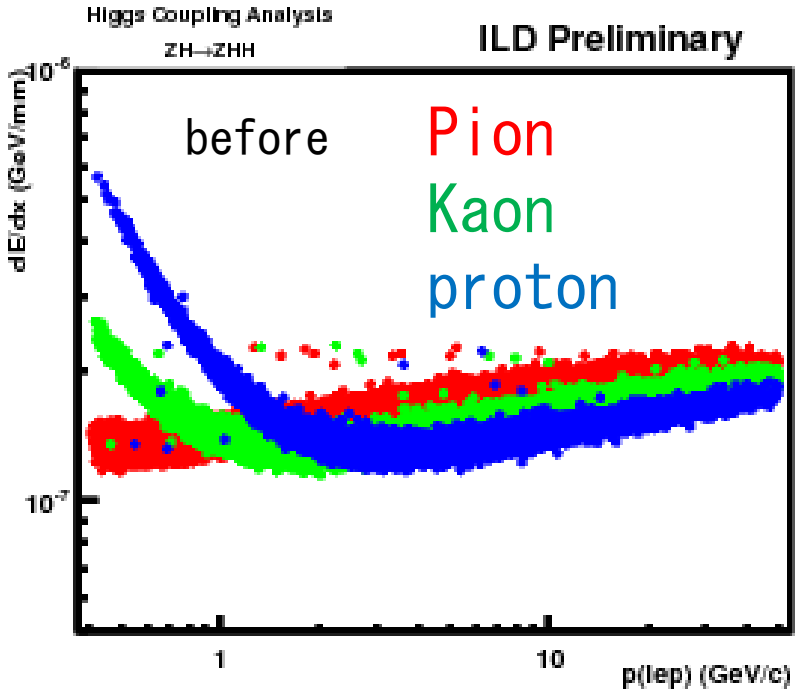


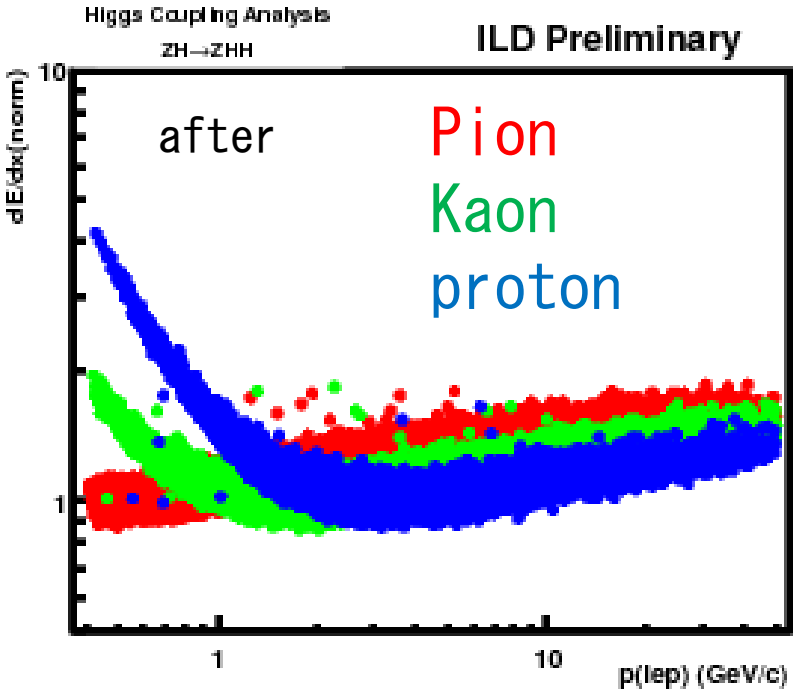


scaling

- Scale dE/dx using MIP pion

$$\left\langle \frac{dE}{dx} \right\rangle_{MIP} = 1.0$$





concerns

- Parameterization
  - What kind of dependence should be checked?
  - Variation of gas gain seems necessary…
- Smearing
  - 5% dE/dx smearing is enough?
- Optimization
  - Truncated mean
  - Other methods to estimate track dE/dx?

Formulation of shower profile

- Fit function:

$$f(x_l, x_t) = ac\frac{(c(x-x_{l0}))^{b-1}\cdot\exp(-c(x-x_{l0}))\cdot\exp(-dx_t)}{\Gamma(b)}$$

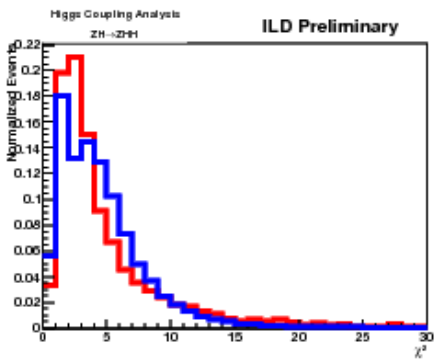
  - a, b, c, d, x_{l0}: parameters
  - Shower max: (b-1)/c (unit: X_0)
  - Absorption length: 1/d mm
  - Expected shower max of incoming electron:

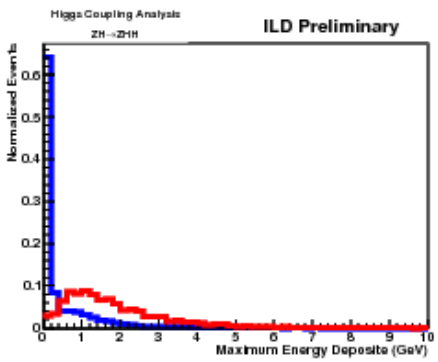
$L_{\max} = 1.0(\log\frac{E_0}{E_c} + 0.5)$ (unit: X_0) E_0: cluster energy

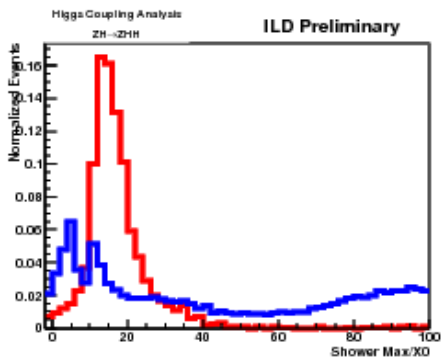
  - Critical energy E_c: $E_C = 0.021\frac{X0}{Rm}GeV$
  - Radiation length: X_0=3.50mm
  - Moliere length: Rm=9.00mm

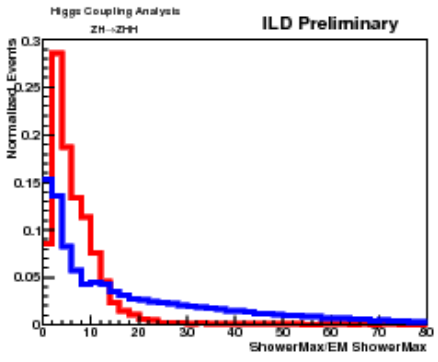
Corrected result

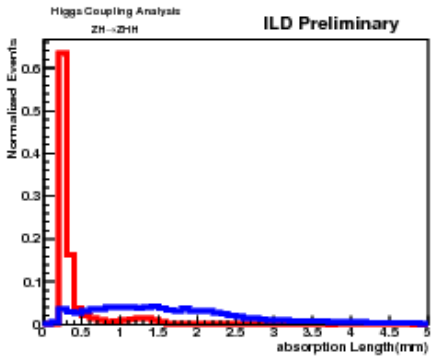
- Electron type

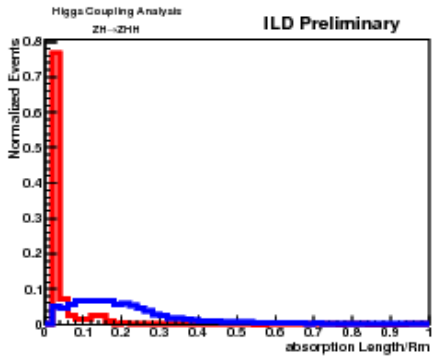


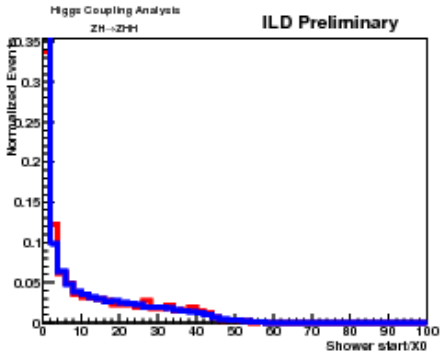










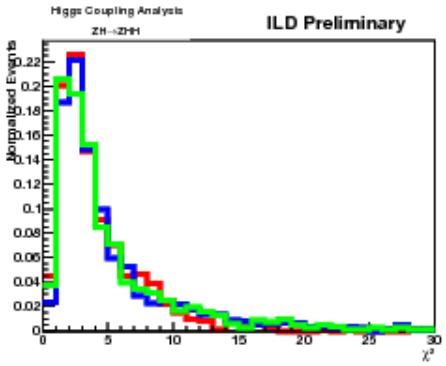


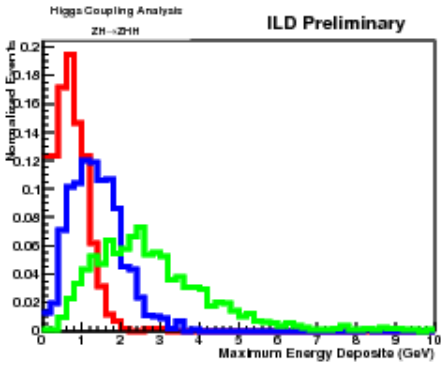
Isolated lepton

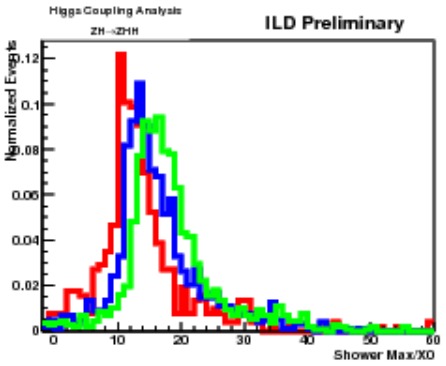
Soft&fake lepton

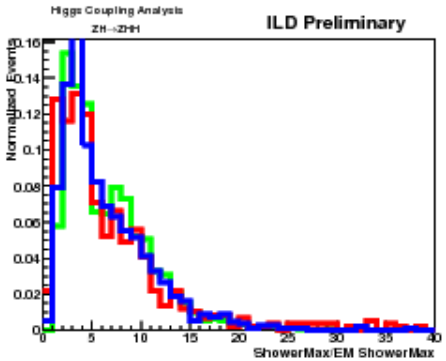
Energy Dependence

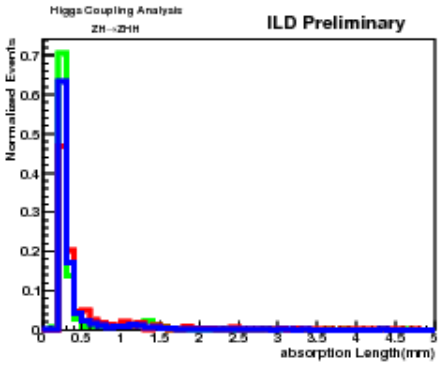
- Electron type

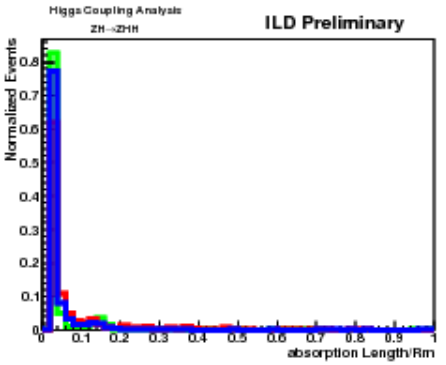


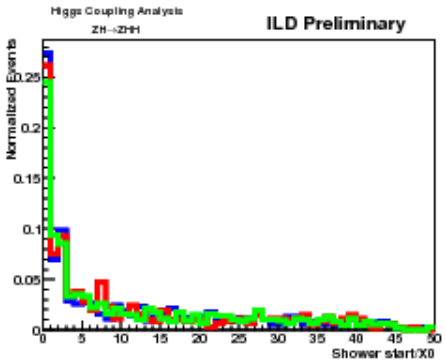












E<20GeV

20GeV<E<40GeV

E>40GeV

concerns

- Good variables for lepton ID?
  - Will not good for cut based selection. MVA will be good
  - Can try soon
- Checking shower shape cluster-by-cluster